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# Software Requirements Document for SAFE HOME

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Version	Date	Author	Change
0.2	12/06/04		Initial Document
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# 1 Introduction

## 1.1 PURPOSE

This document details the functional and nonfunctional requirements for the SAFE HOME system, especially the needs for the SAFE HOME project.

This document focuses the specification for the SAFE HOME project, including the description on user interface, cots device, sensor, medicine, bathroom, eating/cooking and housework. The focus of this document is on medication, bathroom and eating/cooking. The functional and non-functional requirements are included.

The main audience for this document is Dr. Mitra, Dr. Chang and Dr. Wang. It is for making the first version of SAFE HOME project.

## 1.2 SCOPE

The product of this project is a demo version of SAFE HOME. It will provide assistant services to old people, disabilities or others need help.

## 1.3 DEFINITIONS, ACRONYMS, ABBREVIATIONS

Term	Description
SH	Safe/Smart Home

## 1.4 REFERENCES

Dean Leffingwell, Don Widrig, *Managing Software Requirements-A Unified Approach*, Addison Wesley 2000

Dean Leffingwell, Don Widrig, *Managing Software Requirements-A Use Case Approach*, Addison Wesley 2003

SRS Template, <http://www.volere.co.uk/template.htm>

X10 Smart Home Website, <http://www.x10.com>

## **1.5 OVERVIEW**

Chapter 2 introduces the overall description of this project, focusing on Medication, Cooking and Bathroom We also supplies all use-cases in Chapter 2.

Chapter 3 covers specific requirements.

## 2 Overall Description

SMART homes have the potential to enable elderly and disabled people to lead independent lives in their own homes. However, the devices and their interactions need to be chosen and designed in such a way that the system as a whole meets the specific needs of the householder. The SAFE HOME is designed to enable its users to design smart home for older persons and persons with disabilities that reflects their needs.

## 2.1 PRODUCT PERSPECTIVE

There is some related research going on for smart environment research:

### 1. Bath: Gloucester Smart House

It is a project about a smart home that can help dementia sufferers to continue to live in their own home for longer. Sensors attached to common domestic items help remind and inform a person that something needs to be done.

### 2. SEARCH: Custodian

The CUSTODIAN project is funded through the European Commission's Telematics for Improving Employment and Quality of Life sector. Its central objective is to enable access to technology and services for older people and people with disabilities and use smart home technology to improve the quality, effectiveness and efficiency of services that support the independent living of disabled and elderly people, which is also in line with Government policy. The devices in a smart home and their interactions can be designed in such a way that the system as a whole meets the very specific needs of the householder.

### 3. University of Florida

At the University of Florida in Gainesville, researchers are using a cell phone to run a home. When someone rings the doorbell, the owners can either hear it or feel their cell phone vibrating and can open their phone and see a picture of the person at the door, relayed through a video camera. If they recognize the visitor, they can push a button on the phone to unlatch the door, or if it's dark and they can't see the visitor, they can push another button to turn on an outside light.

Other related works are, such as Essex – intelligent inhabited environment, Microsoft research – easy living, MIT – affective computing, Siemens – smart home.

#### 2.1.1 Concept of Operations

- Medication:

1. SH will have the scanner to scan the barcode of the medicines.
2. The system has a complete track of all the medicine. For example, if children take some medicines by accident (without input the password or doesn't meet some conditions), the system will alarm, and the parents can find out the loss of medicine and what kind of medicines was taken. Meanwhile, it will remind the patient to get some more when in lack of some medicines.
3. Medicine dispenser that operates based on identification of the user
4. SH will remind occupant to take medicines at appropriate times (including waking up occupant to serve the reminders) and record doses and to dole out correct amounts of medicine for the user. The medication dispenser is attached to a timer and alarm. In the central computer, we have a database to store the detailed information of what kinds of medicine they have to take and what time to take. Then there is a kind of alarm or display to remind and show record. The timer is set to go off when his medication should be taken. When the timer goes off, the alarm alerts the user and the medication dispenser unlocks to allow him to take his medicine.
5. SH should have the ability to automatically record occupant medical condition each day (including medicines taken, heart beat, pressure, weight etc for medical analysis purposes).
6. SH has the ability to know the collision of the medicines. For example, what kind of medicines can't be taken together in a time period.
7. The medicine system has voice call system, providing verbal or automatic medication reminders.
8. Store and maintain medical data in a private, secure and protected manner and yet permit authorized users to access the system. We may place all the medicine in a certain place, so the customers have to go there to take medicine. We have a voice system for blind people: it will guide you where the medicine is and how much you should take. Here is a display to show the list of the medicine to take.

9. The system has complete and detailed information of all kinds of medicines home. So, it can tell you how to take those medicines and whether the medicine in storage is valid.

10. SH has an automatic medicine injection machine. Some of the medicines need to be injected to occupant's body. And if they live alone, there are no people who can help the user to do it. Hence, SH has the machine.

- Eating/Cooking

1. There is a Kitchen computer system. In kitchen, all kinds of sensors are very important to get rid of dangerous accidents: smoke detector, fire detector, carbon monoxide detector, etc. If the system find some dangerous, it will turn off the power and gas of kitchen.

2. Online recipe suggestions with chef demonstration, ingredient ordered via Internet. Moreover, after reading on the internet, SH should have the ability to generate the "health menu" to the user.

3. SH should have the ability to calculate all the information of the dishes that the user wants to eat.

4. Smart refrigerator – checks stock, orders automatically using Internet connection. The temperature of refrigerator can also be digitally controlled. And SH should have the ability to order the "health food" online for the occupant.

5. Oven programmable to cook when you're out. The devices in kitchen can be controlled with the central controller. For example, we can control how long to cook soup with cooker; how long to bake breads with oven.

6. Automatic breakfast – coffee, kettle & toaster

7. With temperature sensors, we can control the cooker and oven precisely with a certain temperature. Plus the time control, we will never make terrible mistaken foods.



8. Machines to clean and dry dishes.

- Bathroom

1. If the householder does not leave the bathroom after a specified time, an alarm is activated

2. Some requirements on cleaning bathroom.

3. Most important part in bathroom is to control the air and water temperature. For instance, the water's temperature can be controlled digitally and real-time, so it will be very convenient for us to take a shower without adjust the temperature for quite a while. The air temperature also needs to be guarded, and then before we take a bath, we can first raise the temperature high enough. This is especially important for old people and patients.

4. There should be a button for user to push and the water will come out in several seconds. The system should have the ability to let the user input how many seconds.

5. About the floor, it should be dried automatically. If it detects the water on the floor, it will use some method to clean it. And it is better to have non-slip material so that the occupant won't fall down easily.

6. The bathtub should have a door so that the user can go out of the bathtub using that door (solving some of the falling problems in the bathroom).

7. Maybe we can try some voice control technology in bathroom since it's really inconvenient to turn on/off the water with soap on hands.

8. We need a system in bathroom in charge of air circle. With this system, we can detect the oxygen content to avoid danger of lack of air. We can also filtrate the air and remove harmful content and smell.

9. Automation is also need on toilet flushing.

These are only the some of our main operations, and there are still some requirements/operations in our document. Refer to section 2.2.

## 2.1.2 Major User Interfaces

### 2.1.2.1 Example Screenshot and description

There are three kinds of main screenshots for special events, reminding, and set up (like medicine, or food, etc). The special events include visitor's coming, warning, telling the user some specific things, etc.

The screenshot of visitor's coming will be like the following.



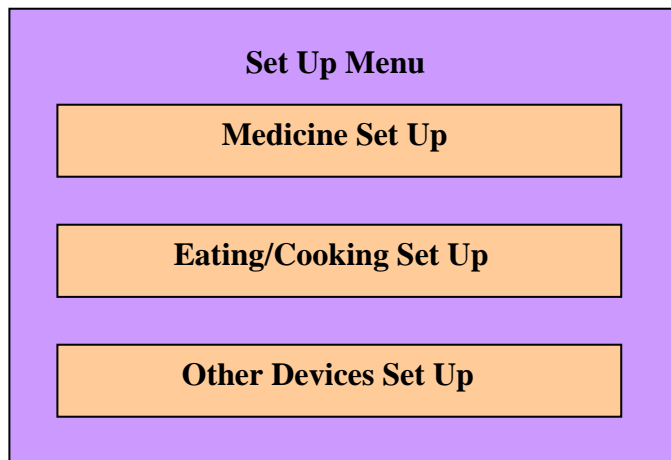
**Here shows the visitor's picture.  
We just use one of the group  
member's cousin's picture as an  
reference.**

The screenshot of the warning event is like the following.



And the specific things can be designed like the warning, or can be designed with some specific pictures. Moreover, the reminding screen also can be designed like that way.

For the set up screenshot, we may have some menu for it.



Inside the Eating/Cooking menu, there are screenshots discussing the dishes.

Healthy Food 1

Lemon Cake

<Some statement>

Select to menu:

☒ Include

☐ Not Include



### 2.1.3 Hardware Interfaces

- ☐ For all other parts, we need a central controller computer and an AD/DA interface to do data acquisition and send out control commands.
- ☐ We also need various interface boards to connect the devices to the control data bus.
- ☐ We assume we have Internet interface, wireless network, and phone system.

### 2.1.4 Software Interfaces

// example: CGI-URL or function signatures etc

### 2.1.5 Communication Interfaces

Ethernet, Wireless Network, Phone system, CDMA or 3G mobile phone

### 2.1.6 Memory Constraints

Have sufficient available memory for high computing

### 2.1.7 Operations

// special operations (if any)

### 2.1.8 Site Adaptation Requirements

[None]

## **2.2 PRODUCT FUNCTIONS**

THE FUNCTIONS ARE AS FOLLOWS:

### **1. General Features**

#### **1.1 Basic Control**

##### **1.1.1 Devices Are Connected to a Central Controller**

1.1.1.1 All the devices are controlled by a central controller. The central controller has a wireless interface to remote control modules, such as remote control panel, motion detectors, etc.

1.1.1.2 The system should have an AD/DA interface to do data acquisition and send out control commands.

1.1.1.3 The system should have Internet interface boards to connect the devices to the control data bus.

##### **1.1.2 User Interface**

###### **1.1.2.1 Mobile Devices and Wireless Router**

The system should have the ability to be controlled by PDA or via internet.

###### **1.1.2.2 Voice and Touch-Screen Control**

Every device should be set-able to be controlled by voice and touch screen by the user, especially voice dialing phone.

###### **1.1.2.3 Phone Interface to Central Controller, Phone Recorder**

Phone should be recordable by central controller.

##### **1.1.3 There Are Displays in Every Room**

When there are some specific events detected by sensors, the system's reply should be shown in the screen.

##### **1.1.4 Control and Communication**

The means for controlling and for communicating should be available in all rooms.

##### **1.1.5 Configuration**

The system should be able to be configured to match the capabilities and needs of the occupants of the SH.

1.1.6 There should be general purpose sensors in every room.

1.1.6.1 Smoke, fire detector

There should have sensors to detect smoke and fire.

1.1.6.2 Gas detector

There should have sensors to detect gas.

1.1.6.3 Motion detector

There should have sensors to detect motion from the user. If the system knows that the user is still at home and doesn't detect the user's motion for a while, it will call 911 directly.

1.1.6.4 Temperature sensor

There should have sensors to detect the temperature of the rooms.

1.1.6.5 Humidity sensor

There should have sensors to detect the humidity.

1.1.7 Cameras for Monitoring and Recording

1.1.7.1 There should have camera in front of the house such that the visitor can be monitored by user and know whether the visitor is his/her friend or not.

1.1.7.2 There should have cameras in every room so that if the user is abroad, user may check home via internet. (Also, because the system has the remote control function, the user may control the objects in his/her home just as if he/she is home so that others may not know whether he/she is home or not. If the user doesn't want control the appliances during his/her vacation, the user can also program his/her home to carry out different functions at different times of the day.)

## **1.2 Basic Features**

1.2.1 Light Devices

1.2.1.1 When you use any room at night, it will automatically turn on the light, but only dimly so as not to hurt your eyes. The longer you remain in the room, the brighter the light gets. This will allow your eyes to adjust.

1.2.1.2 The system should be able to know whether there is adequate light or not.

1.2.2 Elevator in Houses More Than One Story

It is easier for elder or disability people to live with an elevator.

### 1.2.3 Air Conditioner System

The system should work with temperature sensors. If the temperature is too high, the system turns on the cool air conditioners. If the temperature is too low, the system turns on the heat. And the system also controls the air quality. If the quality is not good compared to the data information stored in the system (the data is set by the user), it turns on the fan or air filter. And it will dial 911 directly if the quality is lower than the lower bound that the user sets up.

### 1.2.4 Automatic Doors

Every door should be set-able to be automatic by the user.

### 1.2.5 Furniture with Central Control

1.2.5.1 The furniture should have the ability to be controlled by the user via push buttons if the user set the function up, for example, there are buttons to open and close drawers.

1.2.5.2 The furniture should have the ability to be controlled by the central computer if the user set the function up, for example, the central computer can move the furniture if it is needed.

### 1.2.6 Curtain Device

The curtain should be able to be set to be automatic (according to the light from the sun), button controlled, or manual controlled.

### 1.2.7 Medicine Reminder

There are reminders to take medicine and help you to recognize different types of medicines.

### 1.2.8 Floor device

1.2.8.1 The floor has the sensor to detect the humid (not only the carpet but also the smooth floor), and if the humid rate reaches an upper bound, we need to turn on a machine to dry the floor. The reason that we have this requirement is that we will go to the bedroom after shower. And if the hair is still wet, the floor might be getting wet and it is safer if we notice that and make the floor become dry.

1.2.8.2 If the sensor of the system detect that the user is falling down, the floor will become soft automatically. Of course we may use carpet to cover the whole floor, but what we mention here is a mattress like thing. One of

the methods to implement it is using cut floors. Every piece of floor can be moved if necessary. If the sensors detect that the user is going to fall down, then the floor in front of him/her will automatically be moved and the mattress will be shown up.

1.2.8.3 If the floor shake (this is in the case that the sensors don't detect the user falling down, earthquake or other things), the system will ask the user what's going on (voice control) and give some help (such as call 911).

#### 1.2.9 Window Device

The house should have the windows with glass that how many amount of light or transparent is controlled by computer.

#### 1.2.10 Computer System

1.2.10.1 The system should have the ability to lock the door automatically if the user goes out and forgets to lock the door.

1.2.10.2 The system should be able to detect and uniquely identify occupant using RFID and other means (such as fingerprints, eye scans).

1.2.10.3 The system should have the function to be set by the user that the user may enter the house according to his/her voice, eye pupils, and figure whorl.

1.2.10.4 The system should connect to the healthy equipments such as sphygmomanometer which are used by the user. If the result is abnormal, the system will make an appointment from a hospital for the user.

#### 1.2.11 Extendable

##### 1.2.11.1 Multiple Users

The system should be able to extend to the system that allows multiple occupants.

##### 1.2.11.2 Internationalization

The system should be able to extend to the system that support different languages, that is, the system can allow for internationalization.

##### 1.2.11.3 Integration with Existing Devices

There should be a way to connect the SH to common COTS devices such as microwave, dishwasher, oven, dryer, washer, etc.

##### 1.2.11.4 Social Interaction



The system should have advanced tele-communication devices and audio-visual devices to provide means of contacting family and friends. This is a very important feature because for the person who lives alone wants others' concern.

1.2.12 SH should work normally if there is no resource for any computer systems.

### **1.3 Safety**

1.3.1 There should be general purpose sensors in every room. Refer to 4.1.1.6.

#### 1.3.2 Fire Distinguisher, Water Sprinkler Head

There should have both manual and automatic fire distinguisher, such as water sprinkler head, etc.

#### 1.3.3 Emergency System

1.3.3.1 There should have emergency exit system inside the house. For instance, if there is an emergency event, the system will combine a lot of knowledge such as probabilities to make decisions to tell the user what to do next (it will also tell the user what is the order of the actions), it might only be EXIT. The reason that we have this requirement is that sometimes when an emergency event happens, the user will be too nervous to think about other things. If we have this system, it will help the user to think.

1.3.3.2 There should have emergency call system, that is, the system need to store some important emergency phone numbers so that if the user wants to contact for some emergency events, he/she may just press the buttons.

1.3.3.3 The system should have variety of means to be provided so that the occupant can quickly contact care providers and emergency services without having to move or speak, etc.

1.3.4 The computer system should have the ability to turn off the fire in the kitchen if the user is not in the kitchen for a certain time (unless the user set up the cooking time). And it should have the ability to turn off the fire if the sensor detects that the pot has abnormal temperature.

### **1.4 Security**

#### 1.4.1 Some Devices to Detect Intruders

There should have some devices to detect intruders.

#### 1.4.2 Alarms Devices

There should have alarm devices. If the sensors detect that there are intruders, the system will set off an alarm, send the user a message on the user's phone (if the user is not home) and automatically dial the police for the user.

#### 1.4.3 Strobe Light

There should have a strobe light on the top of the house. Once there are intruders, it will be turned on by the central computer and help police to find the house easily.

#### 1.4.4 Self-Defense Devices

There are useful devices for the user to self-defense. If a thief comes in, the user can use these devices.

#### 1.4.5 Computer System

1.4.5.1 The system should have its own protocol so that others will be hard to intrude by computer.

1.4.5.2 The system should have strong anti-virus software.

### **1.5 Reliability**

#### 1.5.1 Generator Device

There should have a generator so that the system won't be shut down in every time period.

#### 1.5.2 Central Computers

There should have two central computers such that if one of them goes down, the other one can help.

## **2. Living room**

### 2.1 TV preference settings

The system should have the function to be set by the user for all the TV setting.

## 2.2 TV monitor connected to camera system

The TV monitor should connect to camera system.

## 3. Bedroom

### 3.1 Sleeping protector

The bed or the pillow has sensors to detect the temperature and physical condition of the user. If the temperature is not correct or something abnormal, that is, if the temperature is higher or lower than regular one, the system will call 911 directly.

## 4. Bathroom

### 4.1 Sauna temperature control

The sauna temperature can be monitored from anywhere in the apartment. When the desired temperature has been reached, a notification is sent to the equipments, such as cell phone, computer.

### 4.2 Bathtub water control

Cut the flow of water into a bathtub when it reaches a pre-determined height, or tune off a hotplate when a saucepan boils dry.

### 4.3 Bathtub Door

The bathtub should have a door so that the user can go out of the bathtub using that door (solving some of the falling problems in the bathroom).

### 4.4 Toilet

The toilet has a sensor to know when the person is leaving and flush automatically.

### 4.5 Automatic clean system

The restroom should have the function that will clean the floor automatically if the user pushes a button. And there should have other related automatic clean stuffs in bathroom.

#### 4.6 Safety Concern

If the householder does not leave the bathroom after a specified time, the alarm should be activated

4.7 The system should be able to control the air and water temperature. For instance, the water's temperature can be controlled digitally and real-time, so it will be very convenient for us to take a shower without adjust the temperature for quite a while. The air temperature also needs to be guarded, and then before we take a bath, we can first raise the temperature high enough. This is especially important for old people and patients.

4.8 There should be a button for user to push and the water will come out in several seconds. The system should have the ability to let the user input how many seconds.

4.9 The floor should be dried automatically. If it detects the water on the floor, it will use some method to clean it. And it is better to have non-slip material so that the occupant won't fall down easily.

4.10 There should have some voice control technology in bathroom since it's really inconvenient to turn on/off the water with soap on hands.

4.11 There should have a system in bathroom in charge of air circle. With this system, we can detect the oxygen content to avoid danger of lack of air. We can also filtrate the air and remove harmful content and smell.

4.12 There is a device embedded in bathtub. If the user finishes wash the body, he/she pushes the bottom and the device will holds him/her out of the bathtub. And there is a dryer embedded in the ceiling to dry him/her.

### 5. Kitchen

#### 5.1 Eating/Cooking

5.1.1 There is a Kitchen computer system. In kitchen, all kinds of sensors are very important to get rid of dangerous accidents: smoke detector, fire detector, carbon monoxide detector, etc. If the system find some dangerous, it will turn off the power and gas of kitchen.

5.1.2 Online recipe suggestions with chef demonstration, ingredient ordered via Internet. Moreover, after reading on the internet, SH should have the ability to generate the “health menu” to the user.

5.1.3 SH should have the ability to calculate all the information of the dishes that the user wants to eat.

5.1.4 Smart refrigerator – checks stock, orders automatically using Internet connection. The temperature of refrigerator can also be digitally controlled. And SH should have the ability to order the “health food” online for the occupant.

5.1.5 Oven programmable to cook when you’re out. The devices in kitchen can be controlled with the central controller. Also, we may remote control the devices. For example, we can control how long to cook soup with cooker; how long to bake breads with oven.

5.1.6 Automatic breakfast – coffee, kettle and toaster

5.1.7 With temperature sensors, we can control the cooker and oven precisely with a certain temperature. Plus the time control, we will never make terrible mistaken foods.

5.1.8 Machines to clean and dry dishes.

5.1.9 Optional requirement

The eating table is near the cooking place. After the dishes being cooked, the system will send them to the table. And the kitchen has automatic cooking system as long as the user sets it up. For example, the salt, oil, turner, pan/pot and the things that the user wants to cook should be put in a specific place. If the user sets up the order of them, they will cook automatically.

## **6. Dressing**

In the dressing room, there are some devices in the wall. If the user needs help, the user needs to push a special **bottom** related to the device that the user wants and it will give help. Ex: If the user wants a chair, the wall will give the user a chair. If the user wants a hand, the wall will give the user a hand.

## **Housework**

After describe the functional requirements in rooms, there are still some requirements of the help of the housework.

For laundry, there should be a clothes wash machine with dryer in SH. And there should have a machine to fold the clothes automatically.

For dishwashing, there should have an automatic dish wash machine with dryer to wash the dishes.

And there are snake-like vacuum cleaners in the barriers between walls and floors. If the user pushes a bottom, it will move and clean automatically. (It has sensors to detect the obstacles and can contract or extend the length.)

## **7. Special devices for disabilities**

### **7.1 Foot-impaired**

7.1.1 In the kitchen, the system should have robot-like things to help the user to cook. (The user may only control the robot to cook.)

7.1.2 The system should have the ability to be controlled by voice.

7.1.3 Every device should be put in lower place so that the user may reach them easily.

7.1.4 The floor should have the function that the user can control the height of a certain piece floor (the floor should be cut into squares). The reason that we have the feature is that the user can't go back to the wheel chair if he/she falls down. With this function, the user may easily go back to the wheel chair.

### **7.2 Hand-impaired**

7.2.1 The system should have the ability to be controlled by foot. For example, the buttons should be in the floor.

7.2.2 As in 7.1.1, the kitchen should have robot-like things to help the user to cook.

7.2.3 As in 7.1.2, the system should have the ability to be controlled by voice.

### **7.3 Visual-impaired**

7.3.1 For the instruction to use the new equipment, we need to make them easily to understand the operations. Use voice menu and instruction with some standardized order of operations for those equipments. The people can be familiar with those machines.

7.3.2 The system should have the ability to let the visual-impaired user get familiar with the environment. So the system should have a good orientation manual (voice) for the user.

7.3.3 All the functions of any equipment are extended with voice output, such as alerting.

7.3.4 Sensors which help to guide people in the room are necessary. When the user is too close to a certain solid objects (such as walls), voice alert is needed to be sent. It's also depending on the setting of certain individuals.

## **7.4 Hear-impaired**

7.4.1 Flash a selected light or lights in every room should be offered to inform the user for special events, such as new phone call, a certain dangerous situation.

7.4.2 Text-telephone should be offered.

7.4.3 Picture communication and video-telephony should be offered considerable benefits by showing the meaning by pictures. For example, if the shower tub reaches a certain temperature the customer set, give the alert on the computer by showing the picture and temperature.

7.4.4 Television supplies limited information to the hearing-impaired people. With signal language needs to add to the television with the subtitle.

## **8. Other important functions**

### **8.1 Medication**

8.1.1 SH should have the scanner to scan the barcode of the medicines.

8.1.2 The system should have a complete track of all the medicine. For example, if children take some medicines by accident (without input the password or doesn't meet some conditions), the system will alarm, and the parents can find out the loss of medicine and what kind of medicines was taken. Meanwhile, it will remind the patient to get some more when in lack of some medicines.

8.1.3 Medicine dispenser that should operate based on identification of the user

8.1.4 SH should remind occupant to take medicines at appropriate times (including waking up occupant to serve the reminders) and record doses and to dole out correct amounts of medicine for the user.

The medication dispenser is attached to a timer and alarm. In the central computer, we have a database to store the detailed information of what kinds of medicine they have to take and what time to take. Then there is a kind of alarm or display to remind and show record. The timer is set to go off when his medication should be taken. When the timer goes off, the alarm alerts the user and the medication dispenser unlocks to allow him to take his medicine.

8.1.5 SH should have the ability to automatically record occupant medical condition each day (including medicines taken, heart beat, pressure, weight etc for medical analysis purposes).

8.1.6 SH should have the ability to know the collision of the medicines. For example, what kind of medicines can't be taken together in a time period.

8.1.7 The medicine system should have voice call system, providing verbal or automatic medication reminders.

8.1.8 The system should store and maintain medical data in a private, secure and protected manner and yet permit authorized users to access the system. We may place all the medicine in a certain place, so the customers have to go there to take medicine. We have a voice system for blind people: it will guide you where the medicine is and how much you should take. Here is a display to show the list of the medicine to take.

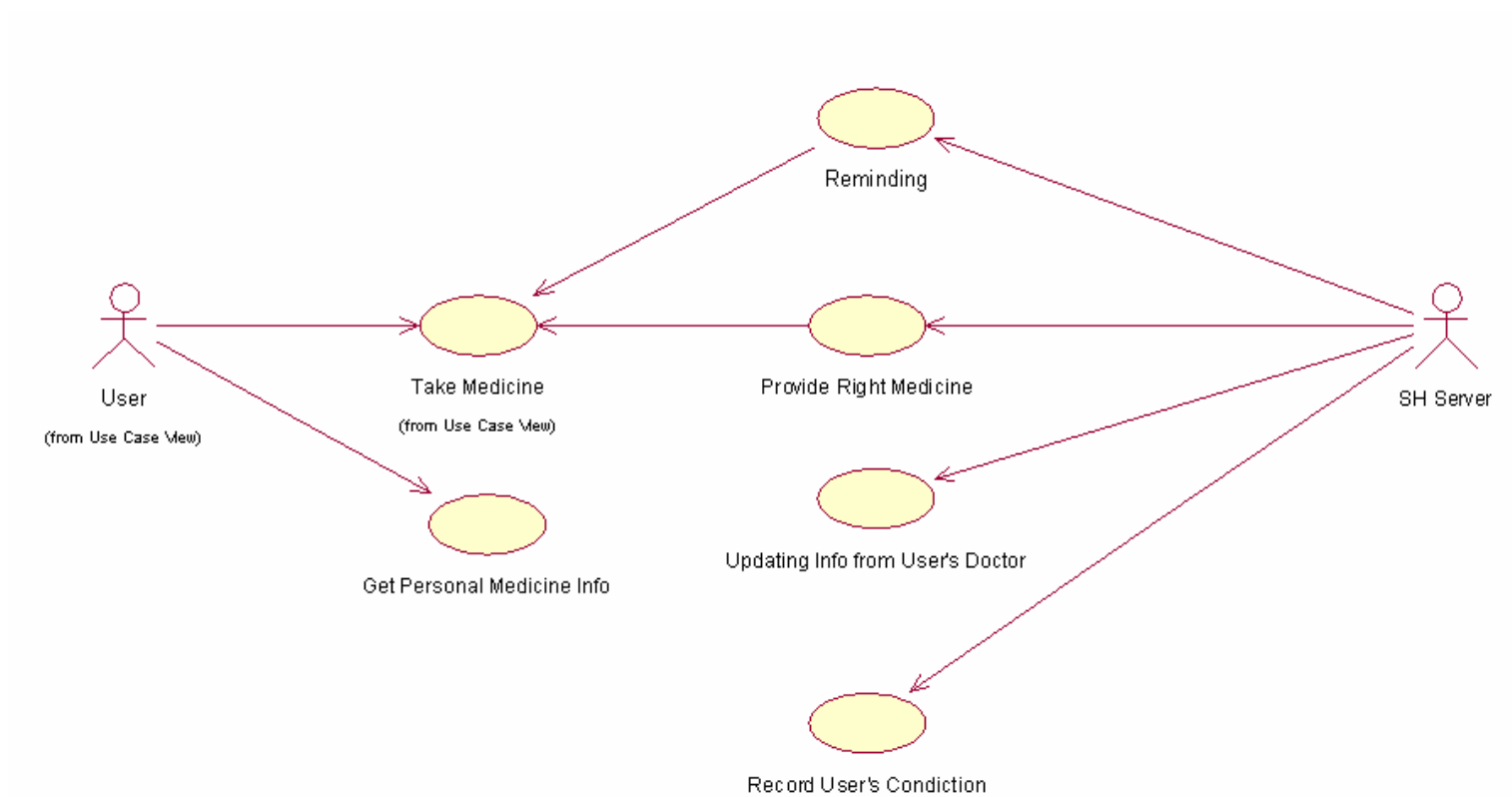
8.1.9 The system should have complete and detailed information of all kinds of medicines home. So, it can tell you how to take those medicines and whether the medicine in storage is valid.

8.1.10 SH should have an automatic medicine injection machine. Some of the medicines need to be injected to occupant's body. And if they live alone, there are no people who can help the user to do it. Hence, SH has the machine.

The overall use-case is shown in the figure below. There are two main actors in the use-case diagram, including customers and SH system.



## 2.2.1 Medical System



### UC1 Flow of Events for the *Take Medicine* Use Case

#### 1.1 Preconditions:

User has the permit to get the medicine

#### 1.2 Main Flow:

After users get the reminder from the system that he needs to take medicine, the user can get the medicine from the system.

#### 1.3 Alternative Flows:

None.

### UC2 Flow of Events for the *Get Personal Medicine Info* Use Case

#### 2.1 Preconditions:

User logs into the medical computer system.

#### 2.2 Main Flow:

After users log into the computer system, it can change his personal data. Also, later he can retrieve his personal data.

### **2.3 Alternative Flows:**

None.

## **UC3 Flow of Events for the *Reminding* Use Case**

### **3.1 Preconditions:**

### **3.2 Main Flow:**

SH will remind occupant to take medicines at appropriate times (including waking up occupant to serve the reminders)

### **3.3 Alternative Flows:**

None.

## **UC4 Flow of Events for the *Providing Right Medicine* Use Case**

### **4.1 Preconditions:**

### **4.2 Main Flow:**

SH can dole out correct amounts of medicine for the user according to the record.

### **4.3 Alternative Flows:**

None.

## **UC5 Flow of Events for the *Updating Info from User's doctor* Use Case**

### **5.1 Preconditions:**

There are new prescriptions for the patient.

### **5.2 Main Flow:**

SH can record doses and other related prescription from doctors .

### **5.3 Alternative Flows:**

None.

## **UC6 Flow of Events for the *Record User's Condition* Use Case**

### 6.1 Preconditions:

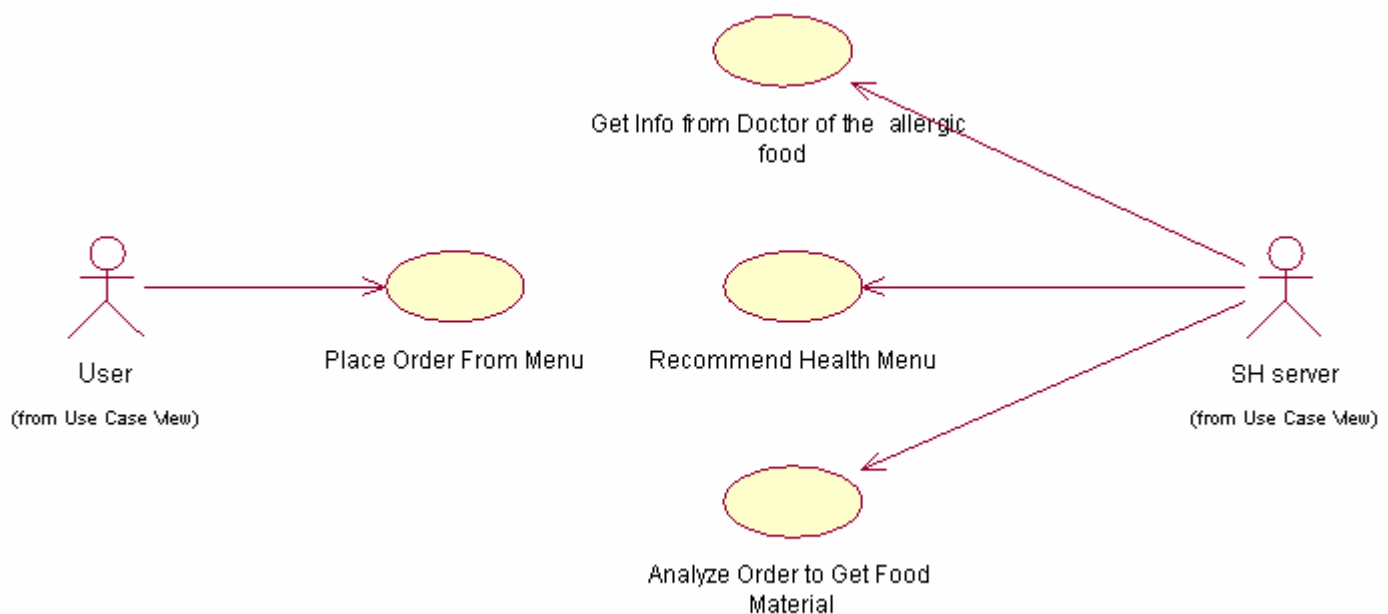
### 6.2 Main Flow:

SH to automatically record occupant medical condition each day (including medicines taken, heart beat, pressure, weight etc for medical analysis purposes).

### 6.3 Alternative Flows:

None.

## 2.2.2 Eating System



## UC1 Flow of Events for the *Place Order from Menu* Use Case

### 1.1 Preconditions:

The system provides a health menu according to user condition

### 1.2 Main Flow:

After the system provides a health menu to the user, user can choose his needs form the recommendation and then place order for the material needed.

### 1.3 Alternative Flows:

None.

## UC2 Flow of Events for the *Get Info from the Doctor of Allergic Food* Use Case

**2.1 Preconditions:****2.2 Main Flow:**

When user has some allergic to food, their doctors can provide these related information and the system can record these information with user identification.

**2.3 Alternative Flows:**

None.

**UC3 Flow of Events for the *Recommend Health Menu* Use Case****3.1 Preconditions:****3.2 Main Flow:**

SH system will provide health menu according to user's current health condition .

**3.3 Alternative Flows:**

None.

**UC4 Flow of Events for the *Analyze Order to Get Food Material* Use Case****4.1 Preconditions:**

A menu has been generated.

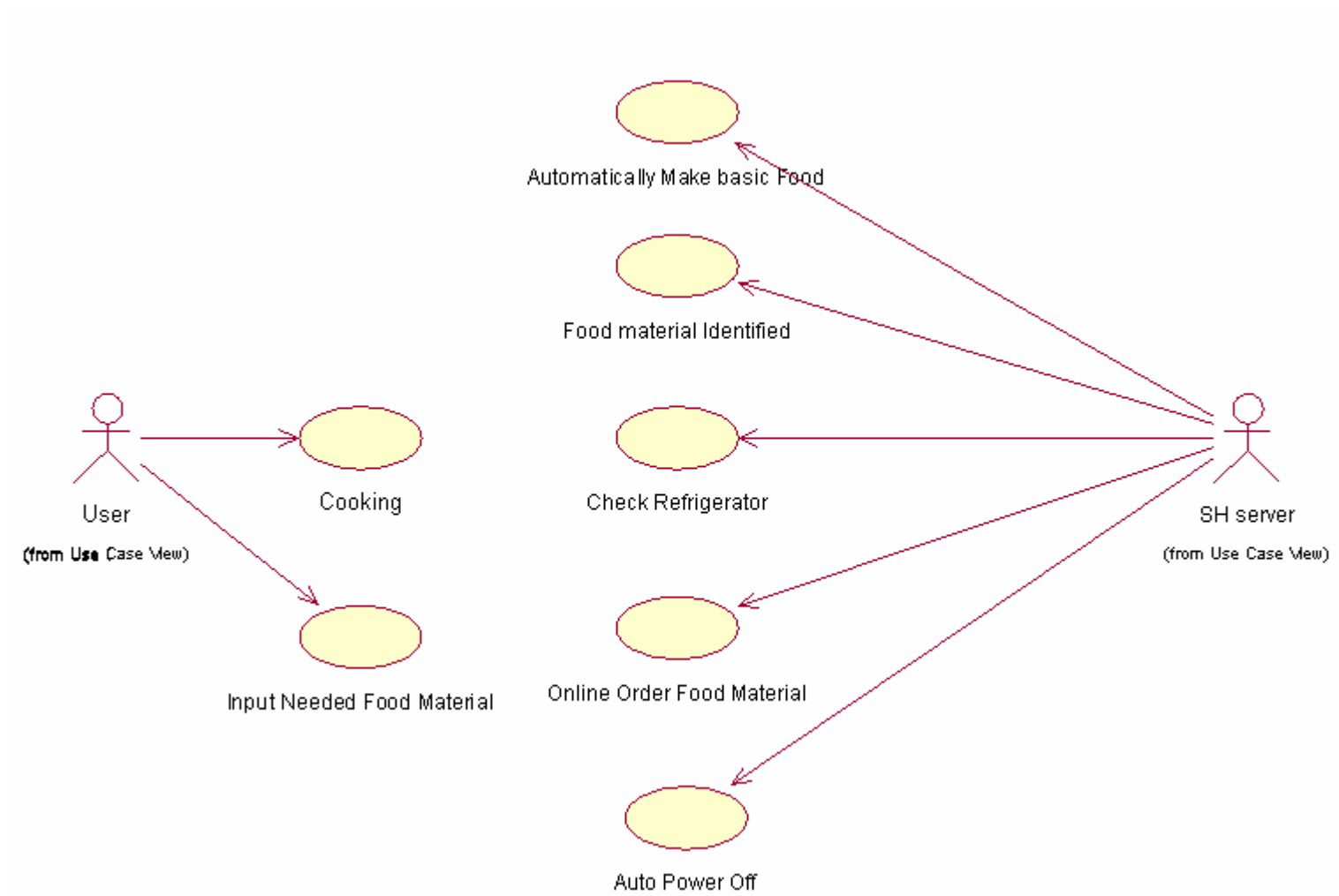
**4.2 Main Flow:**

According a certain menu, the SH system can analyze the ingredients and generate the list of materials needed for the food.

**4.3 Alternative Flows:**

None.

### 2.2.3 Cooking System



#### UC1 Flow of Events for the *Cooking* Use Case

##### 1.1 Preconditions:

All the needed materials are ready.

##### 1.2 Main Flow:

User can cook by some support of SH system, especially for person with disabilities.

##### 1.3 Alternative Flows:

None.

#### UC2 Flow of Events for the *Input Needed Food Material* Use Case

**2.1 Preconditions:****2.2 Main Flow:**

Users can input needed food material when he needs.

**2.3 Alternative Flows:**

None.

**UC3 Flow of Events for the *Automatically Make Basic Food* Use Case****3.1 Preconditions:****3.2 Main Flow:**

According to user's instruction, the system can help to make some food which is with routine process, such as milk, bread, etc.

**3.3 Alternative Flows:**

None.

**UC4 Flow of Events for the *Identify Food Material* Use Case****4.1 Preconditions:****4.2 Main Flow:**

For any food, the system can identify the information according to the barcode. The system can tell the detailed information about ingredient.

**4.3 Alternative Flows:**

None.

**UC3 Flow of Events for the *Automatically Make Basic Food* Use Case****3.1 Preconditions:****3.2 Main Flow:**

According to user's instruction, the system can help to make some food which is with routine process, such as milk, bread, etc.

**3.3 Alternative Flows:**

None.

**UC5 Flow of Events for the *Check Refrigerator* Use Case**

**5.1 Preconditions:****5.2 Main Flow:**

The system can check the stock in the refrigerator automatically and report the missing materials.

**5.3 Alternative Flows:**

None.

**UC6 Flow of Events for the *Online Order Food Material* Use Case****6.1 Preconditions:****6.2 Main Flow:**

If there are any missing material which is not stored in refrigerator , the system can help to order these material on line.

**6.3 Alternative Flows:**

None.

**UC7 Flow of Events for the *Auto Power Off* Use Case****7.1 Preconditions:****7.2 Main Flow:**

The main system can control the system. When any cooking appliance has been left for doing nothing for a certain minutes according to user's setting, it will do power off automatically.

**7.3 Alternative Flows:**

None.

## **2.3 USER CHARACTERISTICS**

Disabilities

They live depending on the system everyday.

Elder people

They also live depending on the system everyday. Some of the services may be not applied every day. And some of them might be used every day, such as medicine system, cooking system, etc.

## **2.4 CONSTRAINTS**

### **1. Techniques**

Due the technique development, some requirements of SAFE HOME are not realistic in current stage.

For example, for falls and bumps,

- . SH to detect falls and to alert care-providers on confirmation
- . SH to soften falls (smart floor, smart walls - or padded rooms)

This requirement needs to have techniques to detect falls which is not applicable for current affordable techniques.

### **2. Cost**

Because SAFE home is for elder people, we should not use expensive techniques or tools for the project. It needs to be in the affordable range.

3. Be useable by non-technical operators with the aid of training and documentation (e.g. help menu)
4. Use technology that must be comfortable, convenient, easy to use and flexible to accommodate the way people actually live.

## **2.5 ASSUMPTIONS AND DEPENDENCIES**

1. We assume that we have interface board for each device we want to control.
2. The Phone system has an interface to our central computer.
3. We have Ethernet and wireless connections in our home.
4. We have all kinds of sensors we need in the projects.
5. We have GUI application and Database to manage and store our smart home configuration for devices.
6. We have enough data acquisition I/O and corresponding drivers.



7. There is a UPS system to keep the system running all the time.
8. The software are depending on the hardware system, including driver and high level application.

## 3 Specific Requirements

### 3.1 EXTERNAL INTERFACE REQUIREMENTS

#### 3.1.1 User Interfaces

Since our consideration is for elder people or disabilities, our software is as simple as possible. There are several kinds of the Graphic User Interface in our system. As we mentioned in 2.1.2, in general, there are three basic GUI. Refer to 2.1.2.

#### 3.1.2 Hardware Interfaces

Our system can be input via several ways, such as remote control, PDA control, etc.

#### 3.1.3 Software Interfaces

The software should be referred to other group's document (based on the platform design). In general, the software should be able to connect to all the devices, database, and web servers.

#### 3.1.4 Communications Interfaces

All the communication is via internet, network communication, such as TCP/IP, etc.

### 3.2 CLASSES

#### 3.2.1 Computer

##### 3.2.1.1 Attributes

	Description
Name/ID	The name or ID for this computer
Password	The password for user to login this computer

##### 3.2.1.2 Entities

	Description
System	The system computers control all the devices

Local	The local computers control a specific device
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### 3.2.1.3 Functions

	Description
Input	Input an event
Output	Output an event

### 3.2.1.4 Events

	Description
Control Devices	Control all the devices in SH
Display	Display all the events in SH
Detect and React	Detect some special events and have the reactions for them
Set Up	Users may set up the events

## 3.2.2 Database

### 3.2.2.1 Attributes

Name: the name of database

### 3.2.2.2 Entities

### 3.2.2.3 Functions

	Description
Add elements	Add the elements of a specific database
Delete elements	Delete the elements of a specific database

### 3.2.2.4 Events

Any action on database

### 3.2.3 Medicine

#### 3.2.3.1 Attributes

	Description
Name	Name of the medicines
Type	Liquid or pills
Utility	Each medicine is for some kinds of symptoms

#### 3.2.3.2 Entities

#### 3.2.3.3 Functions

Refer to functional requirements

#### 3.2.3.4 Events

Any action on medicines

### 3.2.4 Food

#### 3.2.4.1 Attributes

	Description
Name	Name of the food
Type	Type of the food

#### 3.2.4.2 Entities

#### 3.2.4.3 Functions

Refer to Eating/Cooking (Kitchen)

#### 3.2.4.4 Events

Any action on food

### 3.2.5 Users

#### 3.2.5.1 Attributes

	Description
Name	Name of the users
Type	Type of the users
Age	Age of the users

#### 3.2.5.2 Entities

	Description
Disabilities	Impaired people who lives alone
Elder people	Elder people who lives alone

#### 3.2.5.3 Functions

Refer to Use case

#### 3.2.5.4 Events

None

## 3.3 PERFORMANCE REQUIREMENTS

SH server supports multiple users. That means the SH have default setting for every user.

SH server updates information online every hour. And updating has the high priority.

SH supports 100 devices including sensors.

The response of SH to handle data from sensor is within 0.1 sec.

## 3.4 DESIGN CONSTRAINTS

1. SH should be designed with the extendibility to new device.
2. The database system needs to be implemented as real-time system with quick response
3. Devices in SH shall be within cost budget
4. Devices in SH shall be easily operated
5. Control system in SH shall be run on a IBM PC compatible
6. All the tools should be implemented in JAVA

7. All the servers need to have enough memory and processor
8. All the device and system should be very reliable
9. All the tools should be compatible with embedded system on the device

### 3.5 SOFTWARE SYSTEM ATTRIBUTES

#### 3.5.1 Reliability

SH runs 24 hours a day and 356 days a year with the fault rate less than 1/10000.

SH uses Linux system to lower the possibility of becoming unstable and crash.

The SH has firewall and anti-virus system.

#### 3.5.2 Availability

SH supports normal electronic equipments. The electric equipments like microwave oven needs not to be especially design for the SH.

#### 3.5.3 Security

none

#### 3.5.4 Maintainability

SH home has a backup system. When the main system is out of order, the backup will continue to work and send message to call Maintainer.

#### 3.5.5 Portability

none

### 3.6 OTHER REQUIREMENTS

For evaluation of the system we have to consider those below

- *Correctness – whether it satisfies the needs in smart home vision document.*
- *Efficiency - amount of computing resources and code required to perform function*
- *Flexibility – how much we can expend the functions of smart home.*
- *Integrity/Security - factors that protect the software from accidental or malicious access, use, modification, destruction, or disclosure*
- *Interoperability - effort needed to couple software and the hardware*

- *Maintainability - ease of maintenance for disabilities and old people*
- *Reliability - factors required to establish the required reliability of the system*
- *Reusability - extent to which it can be reused for other people*
- *Testability - effort needed to test to ensure performs as intended*
- *Usability - effort required to learn, operate, prepare input, interpret output*
- *Availability - factors required to guarantee a defined availability level for the system, for example, how long the UPS can hold.*

## Document Control

### CHANGE HISTORY

Revision	Release Date	Description [list of changed pages and reason for change]

### DOCUMENT STORAGE

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